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recommends the "use of the Persian Insect Destroyer, one package of which suffices for a good sized dog. The powder should be well rubbed in all over the skin, or the dog, if small, can be put into a bag previously dusted with the powder; in either case the dog should be washed soon after."

One of the most serious insect torments of the tropics of America is the *Sarcopsylla penetrans*, called by the natives the Jigger, Chigoe, Bicho, Chique, or Pique (Pl. 13, fig. 8, enlarged; *a*, gravid female, natural size). The female, during the dry season, bores into the feet of the natives, the operation requiring but a quarter of an hour, usually penetrating under the nails, and lives there until her body becomes distended with eggs, the hind-body swelling out to the size of a pea; her presence often causes distressing sores. The Chigoe lays about sixty eggs, depositing them in a sort of sac on each side of the external opening of the oviduct. The young develop and feed upon the swollen body of the parent flea until they mature, when they leave the body of their host and escape to the ground. The best preventative is cleanliness and the constant wearing of shoes or slippers when in the house, and of boots when out of doors.

NOTE.—All the figures on Plate 13, except 8 *a*, are enlarged.

A TRIP TO THE GREAT RED PIPESTONE QUARRY.

BY C. A. WHITE, M. D.

THE Great Red Pipestone Quarry, from whence the Indians occupying a large portion of the North American continent have from time immemorial obtained the material for their pipes, has become almost as famous among those who speak the English language as among the aborigines themselves, who, to some extent at least, regard it as a sacred place. This is largely due to the interest which has been

Fig. 3.

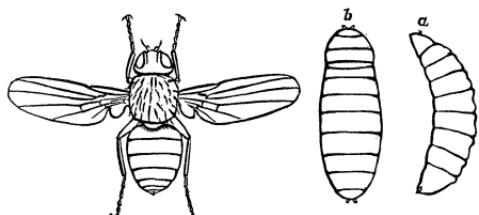


Fig. 7.

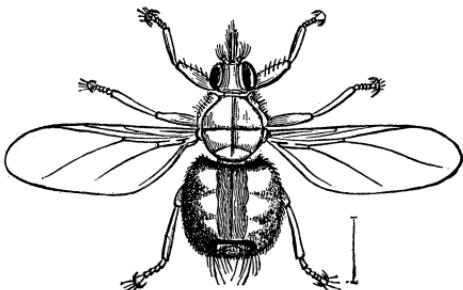


Fig. 9.

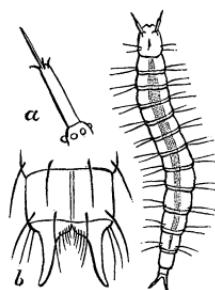


Fig. 4.



Fig. 12.

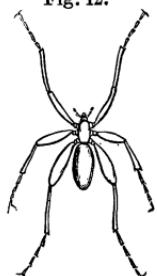


Fig. 2.

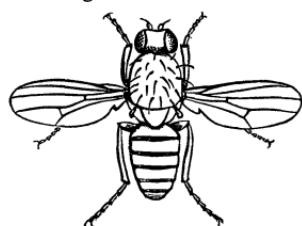


Fig. 5.

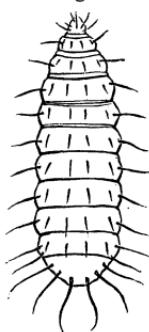


Fig. 10.

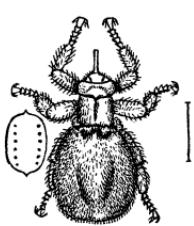


Fig. 1.

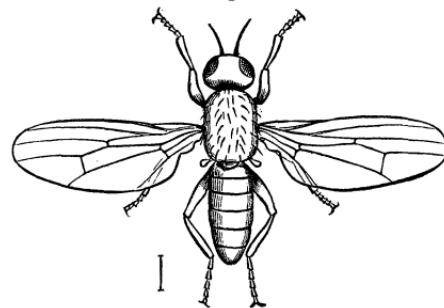
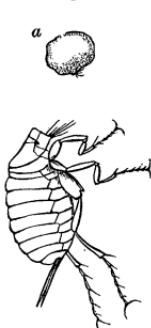


Fig. 6.



Fig. 8.



13.

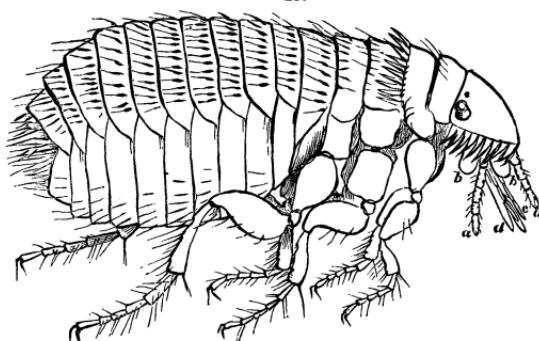
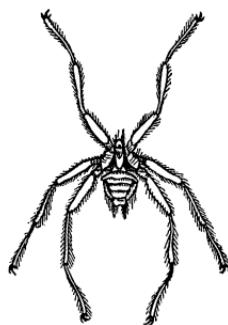


Fig. 11.



excited by the observations of Catlin and Schoolcraft upon the habits, customs and legends of the Indians, but more especially to the unique poetic form in which our much-loved Longfellow has rendered some of them in his "Song of Hiawatha." Before the reader goes farther let him take down this strange song and read the "Peace-pipe," after which he will better understand the references which follow. In addition to this I will give the substance of the legends which occur in various forms among the Indians of the North-west concerning this famous locality.

"Many ages ago the Great Spirit, whose tracks in the form of those of a large bird are yet to be seen upon the rocks descending from the heavens, stood upon the cliff at the Red Pipestone. A stream issued from beneath his feet, which, falling down the cliff, passed away in the plain below, while near him, on an elevation, was the Thunder's nest in which a small bird still sits upon her eggs, the hatching of every one of which causes a clap of thunder. He broke a piece from the ledge, and formed it into a huge pipe and smoked it, the smoke rising in a vast cloud so high that it could be seen throughout the earth, and became the signal to all the tribes of men to assemble at the spot from whence it issued, and listen to the words of the Great Spirit. They came in vast numbers and filled the plain below him. He blew the smoke over them all, and told them that the stone was human flesh, the flesh of their ancestors, who were created upon this spot; that the pipe he had made from it was the symbol of peace; that although they should be at war, they must ever after meet upon this ground in peace and as friends, for it belonged to them all; they must make their calumets from the soft stone, and smoke them in their councils, and whenever they wished to appease him or obtain his favor. Having said this, he disappeared in the cloud which the last whiff of his pipe had caused, when a great fire rushed over the surface and melted the rocks, and at the same time two squaws passed through the fire to their places beneath

the two medicine rocks, where they remain to this day as guardian spirits of the place, and must be propitiated by any one wishing to obtain the Pipestone before it can be taken away."

While tracing up to their original ledges in North-western Iowa and the adjacent parts of Dakota and Minnesota, the boulders of red quartzite profusely scattered in the drift of Western Iowa and Eastern Nebraska, I was led to visit this famous locality, and now propose to give a brief description of its real character and surroundings. But while correcting the fallacies of the Indian legends, no wish is entertained of diminishing popular interest in them, nor in the beautiful rendering of them by the poet; yet every naturalist, however attractive legendary lore or poetic forms of expression may be to him, really desires to know the exact truth, even if it diminishes the pleasure he feels in the enchanting narrations of story or song.

Leaving Sioux City and going northward along the east side of the Big Sioux River, we soon pass the northern limit of the bluff formation, with the strange beauty of its smoothly rounded hills, described in a former number of the *NATURALIST*, and enter upon the broad prairie which continues without interruption far to the eastward, still farther to the northward into Minnesota, and farther still to the westward towards the Rocky Mountains. Rocks of Cretaceous age are occasionally exposed in the bluffs of the river for a dozen miles above its mouth, but being friable, they are soon lost from sight beneath their own debris and the heavy drift-mantle that everywhere covers the earth; and the only rocks we see in many miles of travel are occasional boulders of granite and red quartzite embedded in the deep, rich soil. Streams of considerable size traverse some portions of this wide region, but they are hardly able to arrest the fierce fires of the prairie which annually prevail, for they rush up to their very margins, and sometimes even leap the watery space and carry on their work of destruction

beyond. A few clumps of willows upon their margins, and a few groves upon the islands or in the bends of the streams, only escape destruction, and are the only objects remaining to give diversity to the landscape, except the bald bluffs bordering the larger streams.

A journey of eighty miles over such a country as this brings us to the north-western corner of the State of Iowa, where we first find ledges of the red quartzite in place, which we have traced as scattered boulders, step by step from the Missouri state line, more than two hundred miles away to the southward.

Following up the Big Sioux from this point, we find the quartzite exposed at frequent intervals along the valley, and reaching Sioux Falls, twenty miles by way of the crooked river, but only ten miles in a direct line north-westward from the State corner, we find a magnificent exposure of the same rock extending across the river, and causing a series of falls of sixty feet in aggregate height, within the distance of half a mile, which for romantic beauty are seldom surpassed.

This quartzite is of a nearly uniform brick-red color, intensely hard, quite regularly bedded, the bedding surfaces sometimes showing ripple markings as distinct as any to be seen upon the sea-shore of the present day, and which were made in the same manner untold ages ago, when this hard rock was a mass of incoherent sand, the grains of which are even now distinctly visible. In a few localities it presents the characters of conglomerate, the pebbles being as clearly silicious as the grains of sand. At Sioux Falls, Fort Dakota is located. Those who have never enjoyed the hospitality of our distant military posts, cannot appreciate the full meaning of that word as we did, in the welcome extended to our tired party, by Col. Wm. A. Olmstead, the Commandant, and Dr. J. Frazer Boughter, the Surgeon.

After divers and sundry ablutions, rendered all the more necessary by many days of toil and travel upon the open prairie beneath a July sun, we prepare ourselves for a day's

rest under the protection of our newly found friends and our country's flag. At Sioux Falls, near the top of the exposure, a layer of Pipestone occurs intercalated with the quartzite, which leads us to believe that the rock at the famous Quarry is the same, and we decide to visit it. After discussing the probabilities of there being roving parties of hostile Sioux in the vicinity, and the necessity for the presence of the good doctor in his hospital for a couple of days, it is finally agreed that he shall accompany us under the escort of an Indian guide given us by the Commandant. Our guide, we are assured, is "a pretty good Indian," notwithstanding the fact that he was one of Little Crow's band who were engaged in the massacres of New Ulm and Jackson, Minnesota—the recital of which, by the survivors, has made our hearts sick as we have listened to them, upon the scenes of the butcheries where the marks of their violence still remain—for is it not six years since all that happened? and did not the missionaries labor faithfully with him during the two years of his imprisonment at Davenport for his crimes?

The morning rose clear and beautiful after a refreshing rain of the previous night, and off we go, "six precious souls," including the reformed baby-killer, who rides before us on his pony with that posture and carriage peculiar to the Indian, his legs dangling upon each side as if every bone in them had been broken and had united by cartilaginous union, while we, the other five, seated in our camp wagon, follow upon the dim road or the *tepe trail* over the broad prairie, striving to keep in sight of our guide, who is sometimes several miles ahead of us. Our course is about north north-east from the fort, and when we lose sight of the narrow, interrupted belt of trees which skirts the Big Sioux, not another tree greets our vision in the whole journey of forty miles, save a single elm by the side of a small creek, where we halt to take our mid-day meal. Here our guide tells us we must gather a bundle of faggots from the willows of the brook, which last year's fires had killed but not con-

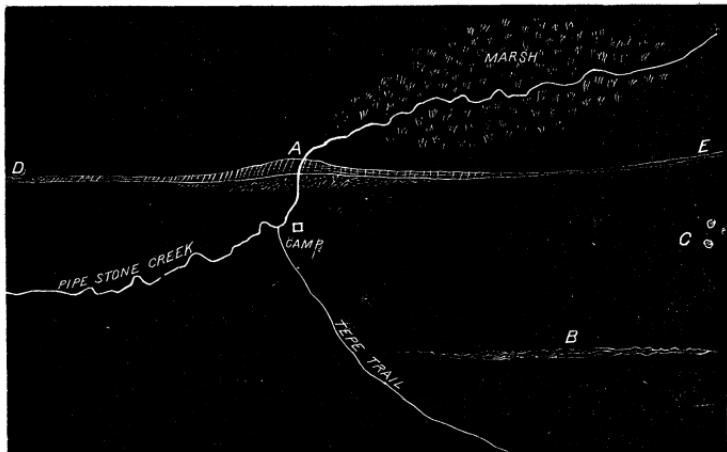
sumed, or we shall have no camp-fire at the Pipestone, where we must pass the night.

On we go, after a hasty meal, for twenty miles of our journey is yet to be made, and we lose sight of the only tree we shall see until we return to the fort. There is nothing around us or beneath us but the gently undulating prairie with its dense growth of grass and flowers, and nothing above us but the open sky. Twice or thrice we detect small exposures of the red quartzite in the depressions occupied by the small prairie streams, with their surfaces scored by the boulder-laden glaciers which moved over them long ago. Now and then a solitary boulder, fellows of those that scored the surfaces of the rocks in place, peers up out of the rich loamy soil. Now and then the whitening skull of a buffalo, or the huge cast-off antlers of an elk, partially hidden by the rank grass, arrests our attention, but these are familiar things, and we pass the time in conversation upon various topics until late in the afternoon, when our guide halts upon an eminence before us. Upon coming up, he merely says "Pipestone" as he points forward, and there, three miles away in the distance, is the famous spot.

We had not expected to see conspicuous features of the landscape anywhere in such a region as this, and yet we were somewhat disappointed to find that the narrow ledge of rocks in the broad shallow valley of a little prairie creek, lying entirely below the general prairie level, constitutes all there is of the Great Pipestone Quarry. As far as the eye can reach in every direction, no "mountain of the prairie," no grove, no tree, no habitation, no living thing except a few birds, is in sight. From our maps and Government surveys, we know the spot is within the State of Minnesota, about thirty miles in a direct line from its south-western corner, and three or four miles from its western boundary. Approaching it, the exposure of rocks appears much greater than it did in the distance, when it looked like a mere line

of broken rocks in the open prairie, for our view then took in the whole region for many miles around it.

The annexed diagram, although drawn merely from memory and without linear measurements, will serve in some degree to give an idea of the relative positions of the principal features of the locality. D E is intended to represent the principal exposure of rocks, which is about a mile in length from north to south, in both of which directions it



Great Pipestone Quarry.

becomes gradually lost from view beneath the surface of the prairie. It faces the west, and reaches its greatest perpendicular height, about twenty feet, at A, where "Gitche Manitoo, the mighty," is supposed to have stood when he took his wonderful smoke, and where the brook falls over it into the plain below. All the rock we see is the red quartzite and a few granite boulders whose original home is still farther north, and we look some time in vain for the Pipestone, for our guide volunteers no information, and we have forgotten in our eagerness to ask him. But our cook calls to supper, and all of us satisfy our hunger, a different thing by the way for *Mazachistina*, alias John Baker, whose appetite seems as insatiate as that of a grist-mill. Having finished this delightful task, he becomes more communicative and

goes to show us the Pipestone, which deposit of aboriginal treasure we find in the plain an eighth of a mile west of the principal exposure of the rock, occupying a shallow ditch (B) a quarter of a mile long, and running parallel with it. The Pipestone is in somewhat thin and usually shaly layers, and only from eight to twelve inches in aggregate thickness, and is the lowest layer found here. The red quartzite rests immediately upon it, and is four or five feet thick at the ditch, and must be removed to get the Pipestone. This has been accomplished with great labor by the Indians, for they do not even now use suitable implements to remove it. The ditch occupies about the middle of the space referred to as the plain, and from it the ground rises gently both eastward and westward. To the westward the rise to the general prairie level is uninterrupted, and no more rock is seen in that direction. To the eastward the gentle rise is interrupted by the abrupt face of the quartzite ledges, between which and the ditch frequent exposures of the same rock are seen upon the nearly level surface. The actual height from the Pipestone in the bottom of the ditch, which is about the lowest point in the vicinity, to the top of the ledges at A, which point is just below the general level of the prairie, is only forty feet, but the dip of all the rocks to the eastward is such as to show an actual thickness of strata amounting to one hundred and fifty feet. This dip causes the top ledges to disappear rapidly to the eastward beneath the marshy surface, and they are seen no more in that direction. The "Medicine Rocks," (C) towards the southern end of the plain, rest directly upon the glacier-smoothed surface of the quartzite. We see the distinct *striae* beneath and around them, and feel almost as if we had caught them in the very act of making their tracks, for they are granite strangers from the northward, and we have visited the place where they were born, and know them and their generation. The two largest of these boulders are some twelve or fifteen feet in diameter, and are the ones believed by the Indians to

cover the two squaws mentioned in the legend. Along the low and less abrupt portions of the ridge of rock, the surface has a glazed and sometimes even a polished appearance, which the legend refers to the effects of the fire through which the squaws passed beneath the Medicine Rocks, but being a geologist and not an Indian, I would suggest that it was produced by grains of sand carried by the almost constant winds, and taken up from the soil, which, although fertile, contains a perceptible quantity.

Many square yards of the glacier-smoothed surface at the Medicine Rocks are covered thickly with Indian hieroglyphics, made by pecking the hard surface with sharp-pointed stones. These are of various grotesque forms, intended to represent persons, animals of the region, turtles, and very many also *in the form of the tracks of a large bird*. It is getting dark, and we defer collecting specimens of Pipestone until morning, and repair to camp and to bed. But memories and passing incidents crowd so thickly upon us that we cannot sleep. A summer storm is sweeping along to the northward of us. We see its dim flashes and hear its mutterings in the direction of the "Thunder's nest." *That* thunder was surely not hatched there, but before darkness overtook us at the "nest"—which by the way is a scarcely perceptible rise of surface—we had found upon the bare rock two or three pairs of the eggs of that "small bird" mentioned in the legend. It is the Night-hawk (*Chordeiles Henryi?*). We smiled at the strange conceit that the hatching of the eggs causes thunder, but we were, nevertheless, startled at the unearthly rumbling cry of the parent bird, as it swooped down over our heads while we were carrying its treasures away.

The morning comes and we ramble along the creek to replenish our wasting bundle of faggots. A few stunted Common Willows (*Salix longifolia?*) grow along the banks, but no "Red Willow" (*Cornus stolonifera*), the bark of which, under the name of Kinnikinnick, is smoked by the Indians

in the place of tobacco, grows here. The Reed-grass (*Phragmites communis*) grows in all wet places here, as well as throughout the north-west, but it is seldom if ever used by the Indians for their pipestems. They commonly use a strong piece of young ash wood, from which they punch the pith to make the bore.

The form and size of the pipes made by the Indians requires so large a piece of stone, that we have no difficulty in obtaining all the specimens we desire from the rejected pieces strewn upon the ground. Our specimens packed in the wagon, and our camp broken up, we start on our return to the fort by the *tepe trail* shown in the diagram. Mazz-chistina mounts at the same time, but starts off towards the Medicine Rocks, around which he makes a rapid turn and overtakes us upon the road. He is utterly silent when we ask him why he went there, but we should doubtless be thankful that we got away with our Pipestone in safety from the wrath of the guardian spirits of the Medicine rocks.

But some one asks, "What is this Pipestone, and what is its composition?" It is chemically a clay (silicate of alumina) colored brick-red with per-oxide of iron. It is too heavy for pipes for white men, and is valued by them almost entirely for its legendary interest. It is heavier, harder, and in every respect inferior to meerschaum,—silicate of magnesia,—yet the purer specimens may be worked without much difficulty with a common saw, file, or knife, and readily takes and retains a considerable polish. Geologically it is metamorphic clay, as the quartzite is metamorphic sandstone. It was originally a layer of clay intercalated between layers of sandstone, and the same metamorphic action that changed the latter to a quartzite, also converted the clay into Pipestone.